POPULATION ESTIMATES FOR PEARY CARIBOU (MINTO INLET HERD), DOLPHIN AND UNION CARIBOU, AND MUSKOX ON NORTHWEST VICTORIA ISLAND, NT, JULY 2005

Northwest Territories Environment and Natural Resources

POPULATION ESTIMATES FOR PEARY CARIBOU (MINTO INLET HERD), DOLPHIN AND UNION CARIBOU, AND MUSKOX ON NORTHWEST VICTORIA ISLAND, NT, JULY 2005

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ABSTRACT

A stratified strip transect aerial survey was conducted in the area north of Minto Inlet and west of the Shaler Mountanins, northwest Victoria, NWT to document the numbers and distribution of caribou (*Rangifer tarandus*) and muskox (*Ovibos moschatus*) during 6 to 8 July 2005. We observed 90 non-calf and 17 calf caribou on transect giving estimates of 835 ± 640 (95% CI) non-calf and 145 ± 129 (95% CI) calf caribou in the range of the Minto Inlet herd. Approximately 13.7% of the caribou observed were calves. Overall, there were 0.023 non-calf caribou per km^2 in the survey area. The survey area included the range of the Minto Inlet Peary caribou herd (*Rangifer tarandus pearyi*) and the northwestern portion of the range of the Dolphin & Union herd caribou herd (*Rangifer tarandus*).

We observed 13 non-calf and 5 calf caribou on transect giving estimates of 66 ± 61 (95% CI) non-calf and 25 ± 23 calf caribou within the range of the Minto Inlet herd. Approximately 27.8% of the caribou observed were calves. The 2001 and 2005 non-calf population estimates were not significantly different. However, a comparison of the mean population estimates suggests that the Minto Inlet herd decline to 1998 levels during the period 2001 to 2005. This decline was likely a result of the cumulative impacts of two successive winters with icing events: winters 2002–2003 and 2003–2004.

We observed 77 non-calf and 12 calf caribou on transect giving estimates of 769 ± 637 (95% CI) non-calf and 145 ± 129 (95% CI) calf caribou in the range of the Dolphin & Union herd in the survey area. Approximately 11.5% of the

caribou observed were calves. The 2001 and 2005 non-calf population estimates were not significantly different. However, a comparison of the mean population estimates suggests that the number of Dolphin & Union caribou in the survey declined between 2001 and 2005. The reason for this decline is not known.

We observed 1,822 non-calf and 321 calf muskoxen on transect giving estimates of 12,062 ± 2,156 (95% CI) non-calf and 2,108 ± 380 (95% CI) calf muskoxen in the survey area. Approximately 15% of the muskoxen observed on transect were calves. The non-calf muskoxen population declined significantly between 2001 and 2005. This decline may be a result of the cumulative impacts of two successive winters with icing events: winters 2002–2003 and 2003–2004.

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INTRODUCTION

The history of the decline of the Minto Inlet caribou herd on northwest Victoria Island, NWT has been described by Gunn (2003) and Nishi and Buckland (2000). Gunn and Fournier (2000) defined the seasonal ranges of this herd. Recent nuclear DNA analysis of caribou tissues (Zittlau *et al.*, in prep) indicated that the Minto Inlet and Dolphin & Union (*Rangifer tarandus*) herds on Victoria Island are distinct from each other and the Minto Inlet herd is most closely related to caribou on Banks Island. Minto Inlet and Banks Island caribou are considered to be Peary caribou (*Rangifer tarandus pearyi*).

Nishi and Buckland (2000) found few caribou in the area west of the Shaler Mountains and north of Minto Inlet during a survey conducted on northwest Victoria Island during early June 1994. Only four were seen on transect in the range of the Minto Inlet herd. These were observed west of Richard Collinson Inlet. A group of 6 to 10 caribou were observed along the coast between Richard Collinson Inlet and Glenelg Bay. Nagy (unpublished data) equipped 10 adult female caribou in this area with satellite collars during August 2003. Satellite location data obtained between 2003 and 2005 indicated that these caribou used the area south and east of Richard Collinson Inlet to the Shaler Mountains during the pre-calving to fall period. These caribou then migrated to and wintered on the mainland near Bathurst Inlet indicating that they were Dolphin & Union caribou (*Rangifer tarandus*) (Nagy, 2003–2005, unpublished data). The animals (Nishi and Buckland, 2000) observed east of

Richard Collinson Inlet may have been some of the first Dolphin & Union caribou to expand there range onto northwest Victoria Island.

Surveys conducted in 1998 (Nagy *et al.*, 2007g) and 2001 (Nagy *et al.*, 2007h) indicated that the number of non-calf caribou in the area north of Minto Inlet and west of the Shaler Mountains increased from 518 ± 210 (95% CI) to 1,271 ± 384 (95% CI). Estimates of the number of non-calf Minto Inlet caribou ranged from 95 ± 60 (95% CI) to 204 ± 103 (95% CI) in 1998 and 2001, respectively, indicating that the population was persisting and appeared to be recovering. The number of Dolphin & Union non-calf caribou in the area increased from 423 ± 201 (95% CI) to 1,067 + 370 (95% CI). The Dolphin & Union herd appeared to have expanded its range into the area immediately west of the Shaler Mountains north to the area between Richard Collinson Inlet and Glenelg Bay during 1998 to 2001 and appears to have continued to use this area during 1998 to 2001. This was in an area where Nishi and Buckland (2000) found very few caribou in June 1994. The number of non-calf muskoxen appeared to be stable in the area – 18,795 ± 2,869 in 1998 and 19,282 ± 3,221 in 2001 – although the number of calves declined significantly during this period. The highest numbers of muskoxen were consistently found in the area north of Minto Inlet between Walker Bay and the head of Minto Inlet. Few wolves were observed in the area (5 in 1998 and 11 in 2001) but the majority of these were found within the range of the Minto Inlet herd.

The caribou and muskox populations on Banks Island have been surveyed every two to four years since 1982 (Latour, 1985; McLean *et al.*, 1986;

McLean, 1992; McLean and Fraser, 1992; Nagy *et al.*, 2007b; Nagy *et al.*, 2007c; Nagy *et al.*, 2007d; Nagy *et al.*, 2007e; Nagy *et al.*, 2007e; Nagy *et al.*, 2007d; Nagy *et al.*, 2007e; Nagy *et al.*, 2007f; McLean *et al.*, 1986; McLean, 1992; McLean and Fraser, 1992; Nagy *et al.*, 2007b; Nagy *et al.*, 2007c; Nagy *et al.*, 2007d). The draft National Recovery Plan for Peary caribou recommended that these Banks Island and Minto Inlet Peary caribou populations should be surveyed during the same years to account for potential movement of animals between the two areas. Systematic aerial strip census surveys designed to obtain population estimates for and Peary caribou and muskox on Banks Island and northwest Victoria Island were conducted in 1998 (Nagy *et al.*, 2007d; Nagy *et al.*, 2007g) and 2001 (Nagy *et al.*, 2007e; Nagy *et al.*, 2007h). In 2005, we conducted a similar survey on northwest Victoria Island with the following objectives:

- to obtain estimates of the number of non-calf and calf caribou and muskoxen,
- to determine the status of the Minto Inlet herd,
- to document observations of wolves and den sites,
- to document the distribution of caribou and muskoxen,
- to recommend whether the current quotas for caribou and muskoxen are sustainable, and
- if necessary, recommend management options to facilitate recovery of the Peary caribou population.

This report summarizes the results of survey complete on northwest Victoria Island during July 2005.

METHODS

In order to conduct a strip transect survey, we partitioned northwest Victoria Island into survey blocks of a size that transect lines, when oriented to intersect major river systems and drainages at approximately a 90° angle, could be flown in about 20 to 25 minutes (Figures 1 and 2). This was done to minimizing observer fatigue. All survey blocks were flown at 20% coverage (transects spaced at 5-km intervals).

In preparation for the survey, we downloaded rasterized versions of the 1:250,000 NTS map sheets covering Northwest Victoria Island from Toporama (http://toporama.cits.rncan.gc.ca/toporama_en.html). These were appended using PCI Geomatica software (Geomatica software, Geomatica) to create a single raster covering the entire study area. We also created a transect line raster and added it to the 1:250,000 NTS raster using Geomatica software. The resulting digital map was imported into OziExplorer GPS software (OziExplorer GPS Mapping Software). Ozi Explorer is a computer software package that is designed to upload and download waypoint and track files from a GPS. We used OziExplorer to create waypoints at the start and end of each transect and gave each of these a unique identification number. These were stored in a digital database on a laptop computer.

Shape files were created for each survey block so that total area of each could be measured using ArcView 3.2 GIS software (Environmental Systems Research Institute). The specifications of the projection used are as follows: UTM Zone 11, NAD 83.

The survey crews were comprised of:

1) a pilot, 2 observers seated in the back seat of the aircraft, and a recorder seated in the right front seat (Cessna 185) and
2) a pilot, 1 observer seated in the left back seat of the aircraft, and a observer/recorder seated in the right front seat (Helio Courier).

Survey crews were equipped with a laptop computer with OziExplorer, a digital map of the survey area, and the digital transect waypoint database installed. Each day we used OziExplorer to download the waypoints of the transect end points from the laptop to the GPS of the aircraft. The pilot used these waypoints to navigated to the start and end points of each transect using the GPS of the aircraft. The aircraft flew at an altitude of 100 m above ground level and airspeed of 160 km/h.

Caribou were counted within and outside of the boundaries of a 500-m wide strip on each side of the aircraft. Muskoxen were counted within the strip. Strip width was marked using wooden dowels taped to the wing struts (Cessna 185) or tape marker on a wire stretched between the tie-down rings and the fuselage (Helio Courier) using the formula:

$$w = W \times h \div H$$

where w is the calculated strip width on the ground, W is the chosen survey strip width, h is the height of the observer on the ground, and H is the chosen survey altitude (Norton-Griffiths, 1987). All sightings of wolves were recorded.

The recorder had a Garmin 12XL GPS equipped with an external antenna mounted on the wind screen of the aircraft. The recorder created a waypoint for each caribou, muskox, and wolf observation and recorded the number of the waypoint and the number and types of caribou, muskoxen, and wolves observed at each waypoint. At the end of each day, the waypoint files were downloaded to the laptop computer. The files were then imported into Microsoft Excel and the waypoint coordinate data (number, latitude and longitude coordinates, date and time) were appended to the observation data. We used the GPS to create a track file of all transects flown (location recorded every 30 seconds). The track files were down loaded to the laptop computer at the end of each flight.

Caribou were classified as adults (cows and yearlings), bulls, calves, or unknown. Muskoxen were classified as adults (age ≥ 1 year) and calves. Observers were equipped with binoculars to help ensure that counts and classifications were done accurately. If an observer had difficulty, the pilot flew the aircraft off transect and flew in a tight circle around the caribou or muskoxen, so that an accurate count and classification could be done. The pilot then flew the aircraft back to the transect and the survey resumed.

The waypoints and track files for all observations made along each transect line within each block were mapped using OziExplorer. All observations that were recorded before the starting point and after the end point of each

transect were deleted. Only caribou that were observed off transect between transect lines within a survey block were included in the analyses. This was done to minimize the probability of including individuals/groups of caribou in the analyses more than once. The numbers of non-calf and calf caribou and muskoxen observed on and off transect for each transect were summarized using Microsoft Excel. The length of each transect was derived using the waypoints for the start and end of each transect and the route function in OziExplorer.

The population estimates and associated statistics were calculated using the Aerial2 version 3.0 method 2 (Krebs, 1999). Estimates for non-calf, calf, and all caribou and muskoxen, respectively, were derived for each survey block. Population and variance estimates from each stratum were combined to derive an overall population and population variance estimate for non-calf, calf, and all caribou and muskoxen, respectively, in all survey blocks.

The estimation of population number and variance from stratified surveys is given in Compton (1995) cited by Johnson *et al.* (2004). The total population number is the summation of individual strata estimates (equation 1):

$$\hat{N}_{total} = \sum_{h=1}^{L} \hat{N}_h$$

where there are L strata units. Assuming that the selection of sample units within each stratum is independent of other strata units, the variance is estimated as the sum of individual variance estimates for each stratum (equation 2):

$$\mathrm{var}_{total} = \sum_{h=1}^{L} \mathrm{var}_h$$

Confidence intervals for the population estimate can be approximated by (equation 3):

$$\hat{N}_{total} \pm t\sqrt{\mathrm{var}_{total}}$$

The degrees of freedom (*d*) for the t-statistic can be approximated by the following formula (equation 4):

$$d = \frac{\left(\sum_{h=1}^{L} a_h s_h^2\right)^2}{\left[\sum_{h=1}^{L}\left(\left.(a_h s_h^2)^2\right/(n_h - 1)\right)\right]}$$

where $a_h = N_h(N_h - n_h)/n_h$ where N_h is the possible number of transects in an individual block and n_h is the actual number of transects flown. The sample variance from each block is denoted as s^2 in the above formula, and L is the total number of strata (Compton *et al.*, 1995) cited by Johnson *et al.* (2004). This assumes that the population estimates and variance estimates from each stratum are unbiased and independent.

We used a two-tailed t-test to determine whether the estimates of the non-calf caribou and muskoxen in 2005 were significantly different from those in 2001. We calculated the t-statistic (t^2) using the following formula (from Section 4.2.1.2, page 62, Gasaway *et al.*, 1986) (equation 5):

$$t^2 = T_{2005} - T_{2001} / [V(T_{2005} + V(T_{2001})]^{0.5}$$

where:

- T_{2005} and T_{2001} = population estimates of non-calf and calf caribou and muskox from surveys in 2005 and 2001, respectively

- $V(T_{2005})$ and $V(T_{2001})$ = variances of population estimates of non-calf and calf caribou and muskoxen from surveys in 2005 and 2001, respectively

We used the following formula to estimate the total degrees of freedom (v_t) associated with the t-statistic (from Section 4.2.1.2, page 62, Gasaway *et al.*, 1986) (equation 6):

$$[V(T_{2005})+V(T_{2001})]^2/\{[V(T5)^2/v_{o2005}]+[V(T_{2001})^2/v_{o2001}]\}$$

where:

- $V(T_{2005})$ and $V(T_{2001})$ = variances of population estimates of non-calf and calf caribou and muskox from surveys in 2005 and 2001, respectively
- v_{o2005} and v_{o2001} = degrees of freedom from surveys in 2005 and 2001, respectively (derived from equation 4).

We mapped the distribution of locations obtained for satellite collared Minto Inlet Peary caribou (Gunn and Fournier, 2000) and Dolphin & Union caribou (J. Nishi, unpublished data; J. Nagy, unpublished data) in relationship to the boundaries of the survey blocks. This was done to determine the relative probability that caribou observed in a survey block belonged to the Minto Inlet or Dolphin & Union herd.

Maps showing the distribution of caribou observed on and off transect, muskoxen observed on transect, and wolves on northwest Victoria Islands were created using ArcView (Environmental Systems Research Institute).

RESULTS

The survey was completed during 6 to 8 July 2005 on northwest Victoria Islands. Weather conditions we nearly ideal and we were able to complete the survey in a relatively short time period. All transect lines could not be flown as planned (Figure 3). We flew survey blocks A and B at 20% coverage as planned, but reduced coverage to 10% in survey block C because of impending poor weather conditions (Figure 3)

Peary caribou

The distribution of non-calf and calf caribou observed during the survey is shown in Figures 4 and 5, respectively. We observed a total of 90 non-calf and 171 calf caribou on transect giving estimates of 835 ± 640 (95% CI) non-calf and 145 ± 129 (95% CI) calf caribou on the island (Table 1). The 2005 estimate of non-calf caribou was not significantly different than that reported for 2001 (Nagy *et al.*, 2007e) (t^2 = 1.192, DF = 48, P>0.05). In comparison, the estimate of calf caribou was significantly lower than that reported for 1998 (Nagy *et al.*, 2007e) (t^2 = 2.134, DF = 80, P<0.05). We observed a total of 113 non-calf and 18 calf caribou on and off transect. There were 15.9 calves per 100 non-calf caribou. Approximately 13.7% of the caribou observed were calves. The majority of these caribou (100 non-calf) and (13 calves) were found in survey block C (Table 1 and Figures 4 and 5).

Figures 6 and 7 show the distribution of satellite-collared Minto Inlet Peary caribou and Dolphin & Union caribou in relation to the boundaries of the survey

blocks. These data suggest that caribou observed in survey blocks A and B were of the Minto Inlet Peary caribou herd, while those in survey block C were of the Dolphin & Union herd.

The total number of caribou observed on transect in survey blocks A and B was 13 non-calf and 5 non-calf caribou giving estimates of 66 ± 61 (95% CI) non-calf and 25 ± 23 (95% CI) calf caribou for the Minto Inlet herd (Table 2 and Figure 8). The total number of caribou observed on and off transect was 13 non-calf and 5 calf caribou. There were 38.5 calves per 100 non-calf caribou. Approximately 27.8% of the caribou observed were calves. The 2005 estimate of non-calf caribou was significantly lower than that reported for 2001 (Nagy *et al.*, 2007e) ($t^2 = 2.382$, DF = 37, $P<0.05$). In comparison, the estimate of calf caribou was not significantly different than that reported for 2001 (Nagy *et al.*, 2007e) ($t^2 = 1.289$, DF = 28, $P>0.05$). These data suggest that the Minto Inlet herd declined between 2001 and 2005. A comparison of the mean non-calf population estimates for 2001 and 2005 suggests that the population declined at an average annual finite rate of -23% per year during this period (Caughley, 1980).

The total number of caribou observed on transect in survey block C was 77 non-calf and 12 calf caribou giving estimates of 769 ± 637 (95% CI) non-calf and 145 ± 129 (95% CI) calf caribou in the range of the Dolphin & Union herd in the area (Table 2 and Figure 9). The total number of caribou observed on and off transect was 100 non-calf and 13 calf caribou. There were 13 calves per 100 non-calf caribou. Approximately 11.5% of the caribou observed were calves. The 2005 estimate of non-calf caribou was not significantly different from that

reported for 2001 (Nagy *et al.*, 2007e) (t^2 = 0.823, DF = 47, P.0.05). Similarly the estimate of calf caribou was not significantly different from that reported for 2001 (Nagy *et al.*, 2007e) (t^2 = 1.824, DF = 78, P>0.05). These data suggest that the number of Dolphin & Union caribou in the area did not change between 2001 and 2005. A comparison of the mean non-calf population estimates for 2001 and 2005 suggests that the population declined at an average annual finite rate of -9% per year during this period (Caughley, 1980).

We found no evidence of caribou mortalities.

Muskox

The distribution of non-calf and calf muskoxen observed during the survey is shown in Figures 10 and 11, respectively. We observed a total of 1,822 non-calf and 321 calf muskoxen on transect giving estimates of 12,062 ± 2,156 (95% CI) non-calf and 2,108 ± 380 (95% CI) calf muskoxen in the survey area (Table 3 and Figure 12). There were 17.6 calves per 100 non-calf muskoxen. Approximately 15% of the muskoxen observed on transect were calves. The 2005 estimate of non-calf muskoxen was significantly lower that reported for 2001 (Nagy *et al.*, 2007e) (t^2 = 3.761, DF = 81, P<0.001). However, the 2005 estimate of calf muskoxen was not significantly different from that reported for 2001 (Nagy *et al.*, 2007e) (t^2 = 1.287, DF = 78, P>0.05). A comparison of mean population estimates for 2001 (Nagy *et al.*, 2007e) and 2005 indicates that the non-calf muskox population decreased at an annual finite rate of -12% per year during this period (Caughley, 1980) (Figure 12).

We found no evidence of muskox mortalities.

Wolves

We observed a total of 12 wolves. The majority of these were found within the range of the Minto Inlet Peary caribou herd (Figure 13).

DISCUSSION

The results of our survey indicate that there were approximately 835 ± 640 (95% CI) non-calf caribou within the 36,021 km^2 area surveyed north of Minto Inlet and west of the Shaler Mountains. Approximately 8% or 66 ± 61 (95% CI) of these caribou were found within the area used by satellite-collared Minto Inlet Pery caribou between 1986 and 1988 (Gunn and Fournier, 2000) and were considered to be Minto Inlet Peary caribou. Approximately 92% or 767 ± 637 (95% CI) of the non-calf caribou were found within an area documented as pre-calving to fall ranges of the Dolphin & Union caribou herd through satellite telemetry between 2003 and 2005 (Nagy, unpublished data).

The results of this survey indicates that the Minto Inlet Peary caribou herd continues to persist, but their numbers declined significantly between 2001 and 2005. This decline was likely the result of the cumulative impacts of the icing events that occurred in the area during winters 2002–2003 and 2003–2004 (Tom Smith, pers. comm.).

The Dolphin & Union herd continued to use the range between Richard Collinson Inlet and Glenelg Bay. Although the population estimates for 2001 and

2005 were not significantly different for this area, the differences in the mean population estimate indicate a decline. This decline was not likely caused by the icing events that occurred on northwest Victoria Island during winters 2002–2003 and 2003–2004 as the Dolphin & Union herd winters on the mainland near Bathurst Inlet. However, freezing rains during the October and November 2004 were reported on the mainland from Alaska to Kugluktuk, NU.

The results of our survey indicate that there were 12,062 ± 2,156 non-calf and 2,108 ± 380 calf muskoxen in the survey area. The number of non-calf muskoxen declined significantly between 2001 and 2005 to approximately 50% of the numbers observed in 2001. There was no change in the number of calves observed between 2001 and 2005. The decline in the number of non-calf muskoxen was likely the result of the cumulative impacts of the icing events that occurred in the area during winters 2002–2003 and 2003–2004 (Tom Smith, pers. comm.). As in 1998 (Nagy *et al.*, 2007g) and 2001 (Nagy *et al.*, 2007h), most of muskoxen were observed in the area north of Minto Inlet between Walker Bay and the head of Minto Inlet.

We observed 12 wolves during the survey. As in 1998 and 2001, the majority of these were found within the range of the Minto Inlet herd.

Given the low numbers of Minto Inlet caribou in the area, the moratorium on hunting established by the Ulukhaktok Hunters and Trappers Committed in 1993 should be maintained.

There continues to be a large number of muskox in the area. As in 1998 and 2001, most of the of muskoxen observed were in the area north of Minto Inlet between Walker Bay and the head of Minto Inlet.

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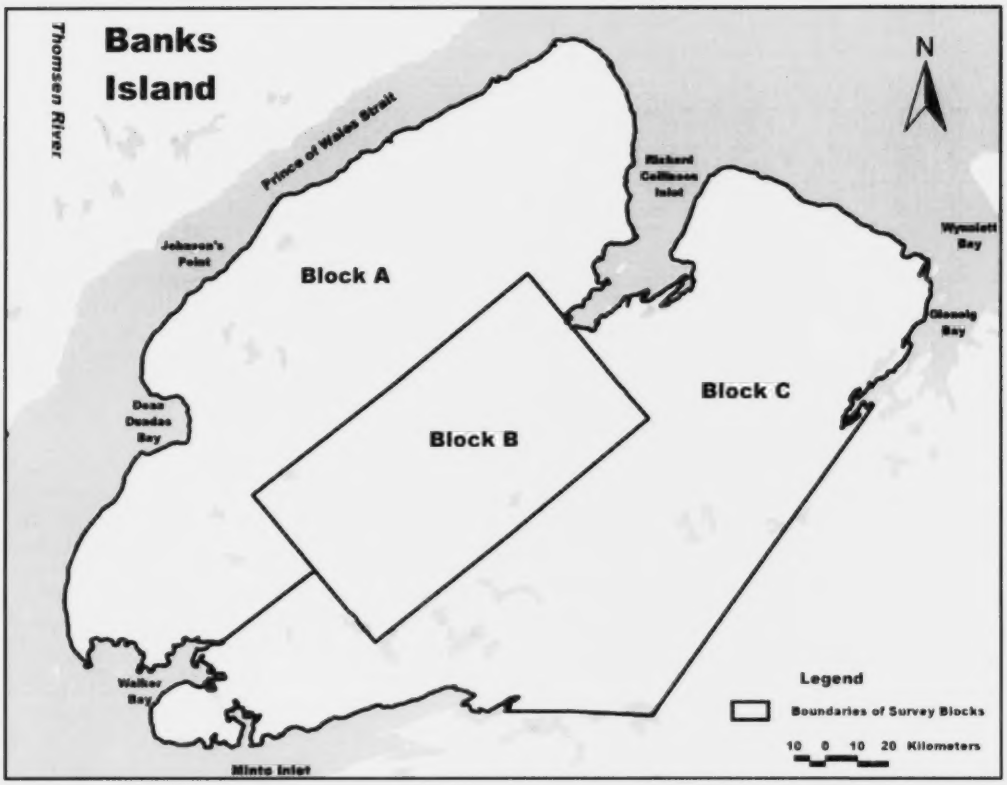


Figure 1. Location of survey blocks for the July 2005 northwest Victoria Island Peary caribou and muskoxen survey.

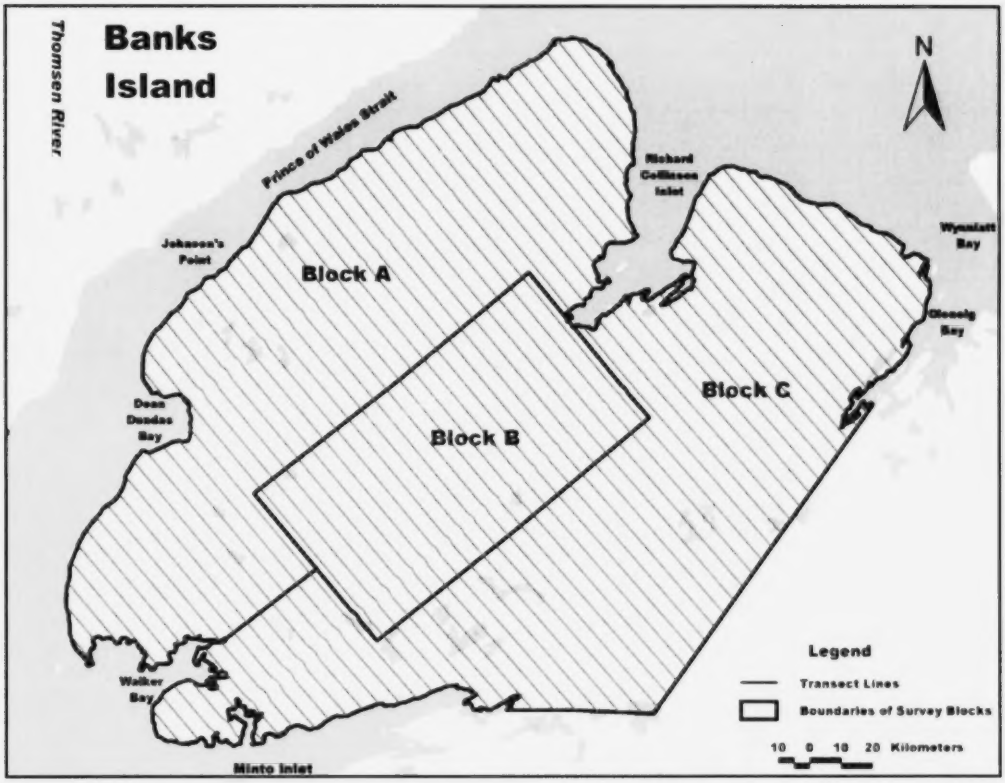


Figure 2. Distribution of survey blocks and transect lines for the July 2005 northwest Victoria Island survey as planned.

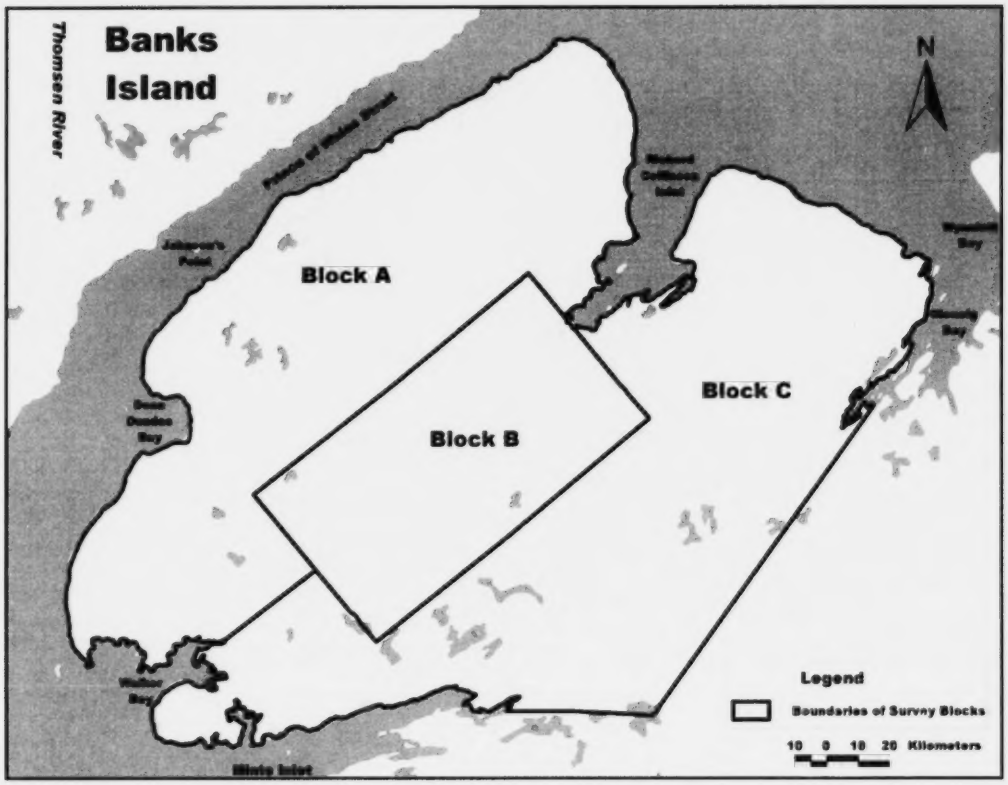
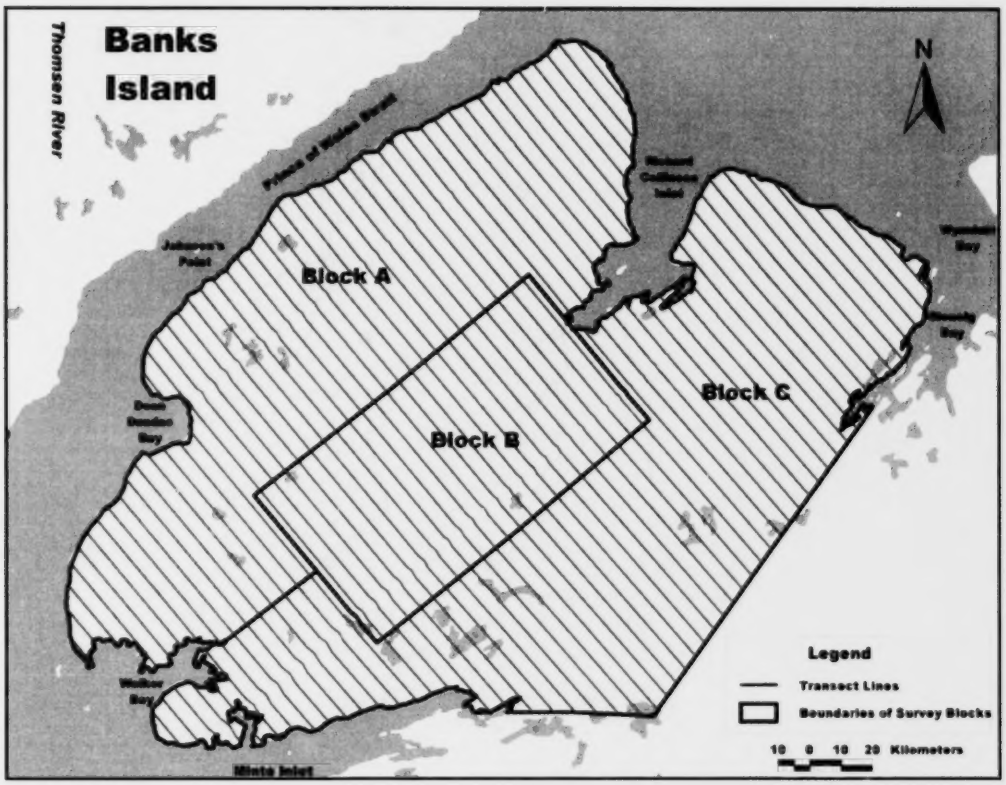


Figure 1. Location of survey blocks for the July 2005 northwest Victoria Island Peary caribou and muskoxen survey.



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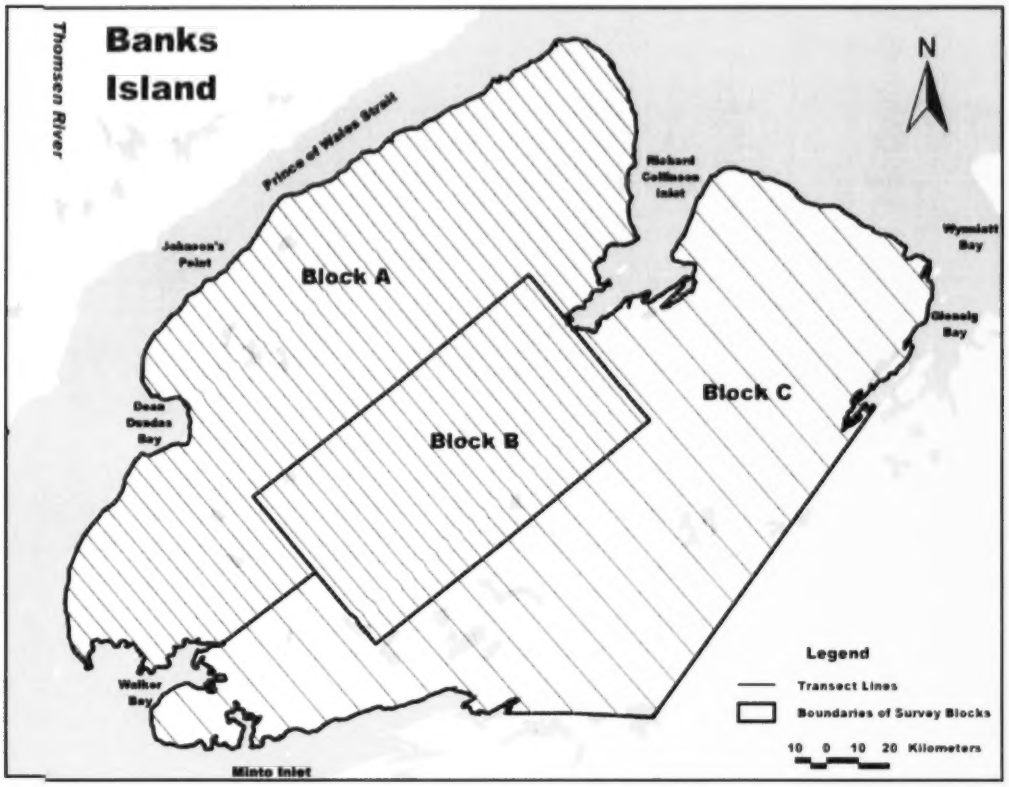

Figure 3. Distribution of survey blocks and transect lines for the July 2005 northwest Victoria Island survey as flown.

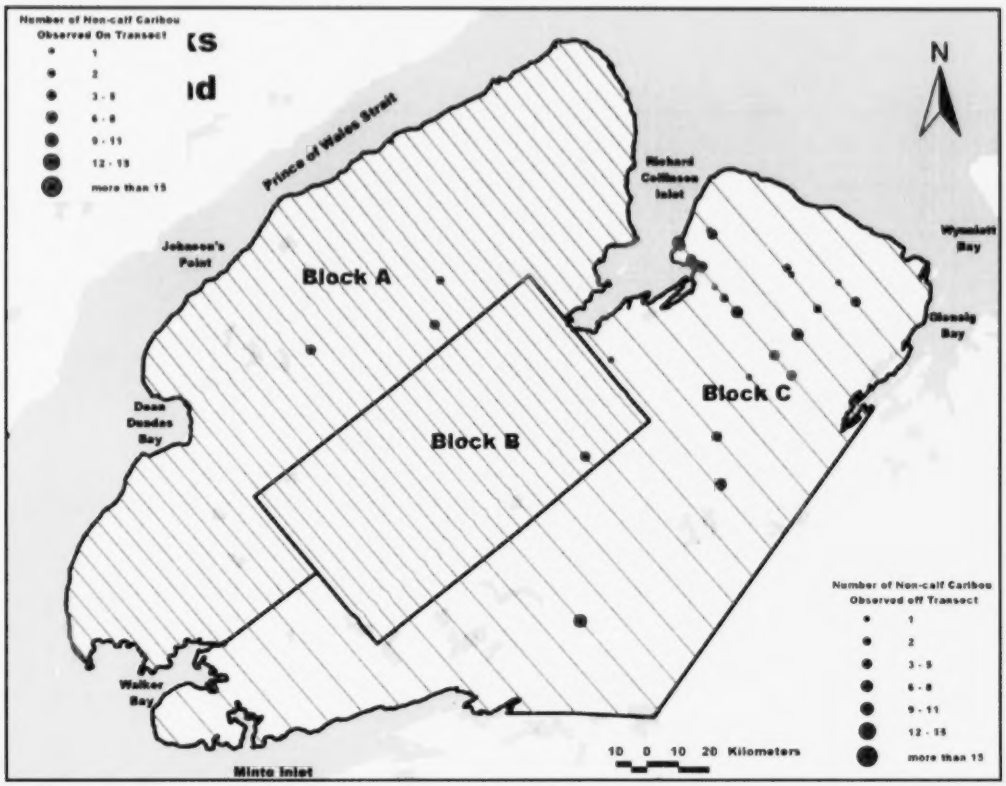

Figure 4. Distribution of non-calf caribou on northwest Victoria Island during July 2005.

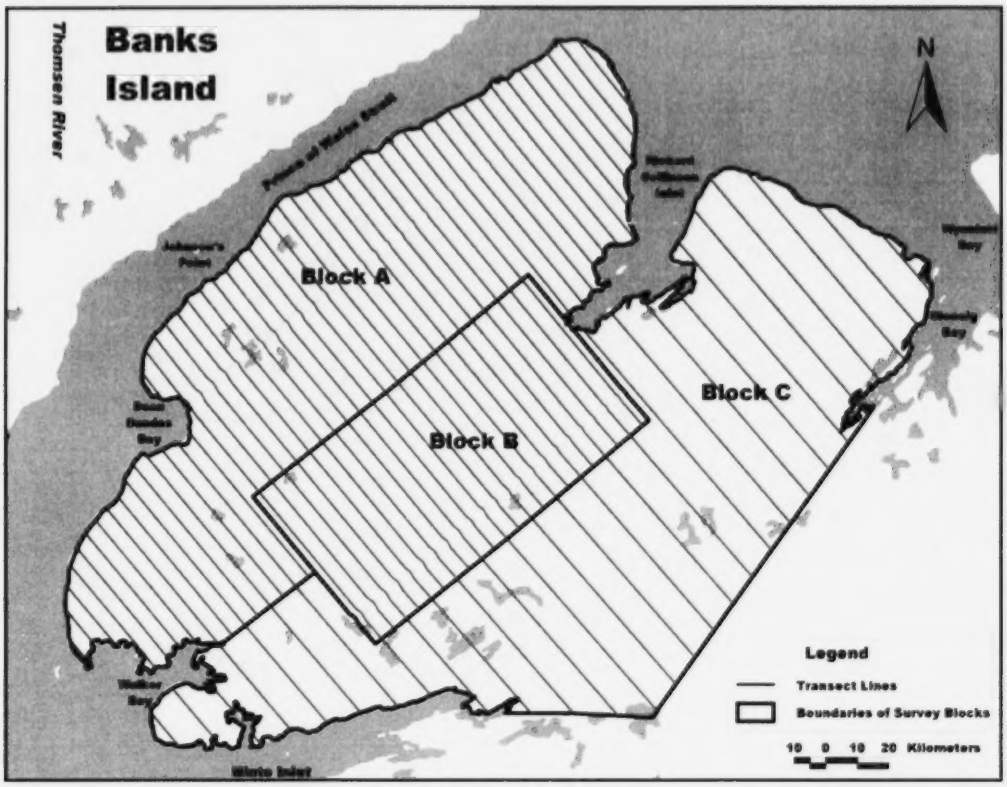

Figure 3. Distribution of survey blocks and transect lines for the July 2005 northwest Victoria Island survey as flown.

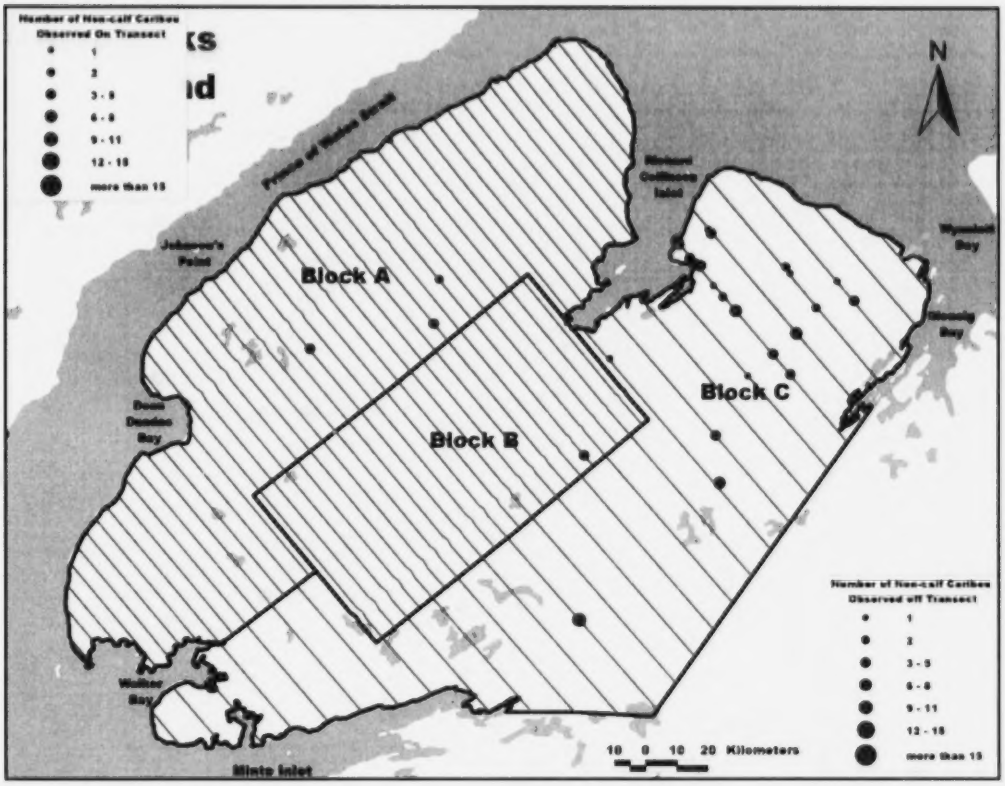

Figure 4. Distribution of non-calf caribou on northwest Victoria Island during July 2005.

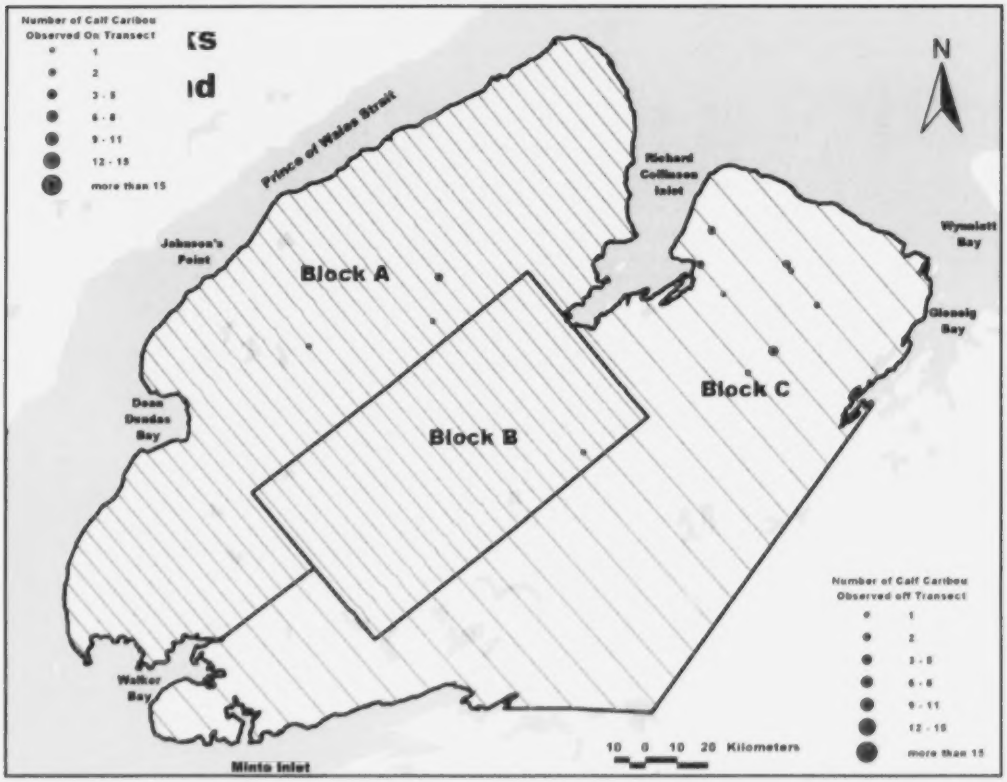

Figure 5. Distribution of calf caribou on northwest Victoria Island during July 2005.

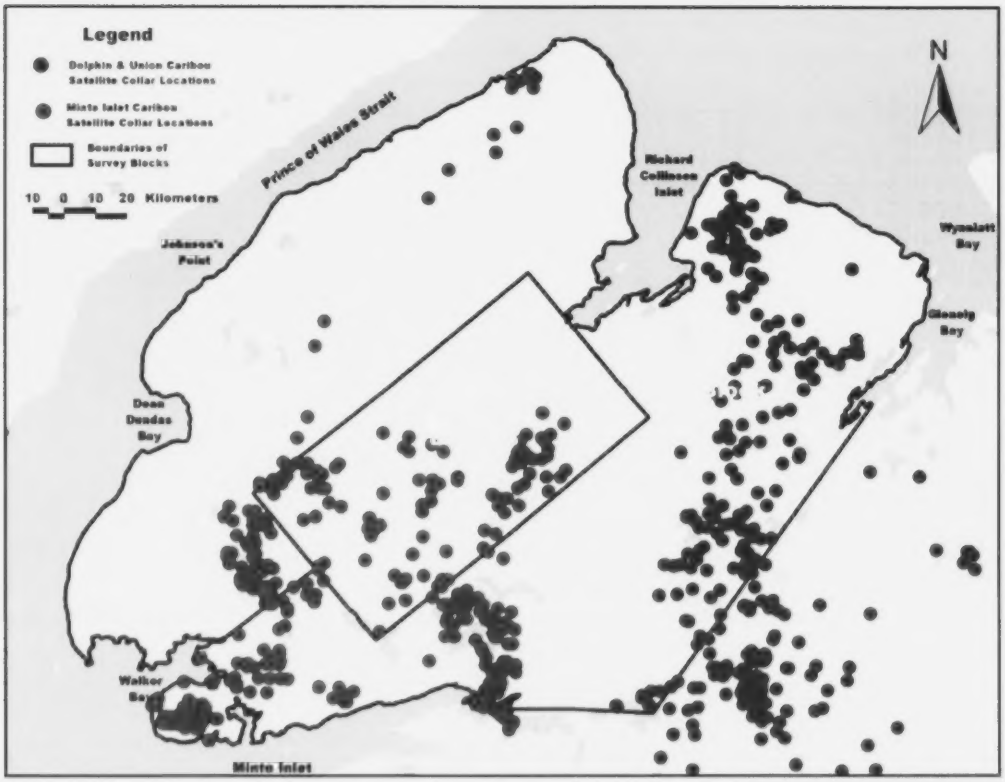

Figure 6. Distribution of satellite collared cow Minto Inlet Peary caribou and Dolphin & Union caribou in relation to the boundaries of the survey blocks on northwest Victoria Island.[A]

[A] Satellite location data are from the followings sources:
- Minto Inlet Peary caribou: 1987 to 1989 (Gunn and Fournier, 2000)
- Dolphin & Union caribou: 1996 to 1998 J. Nishi (unpublished data) and 2003 to 2005 (J. Nagy, unpublished data)

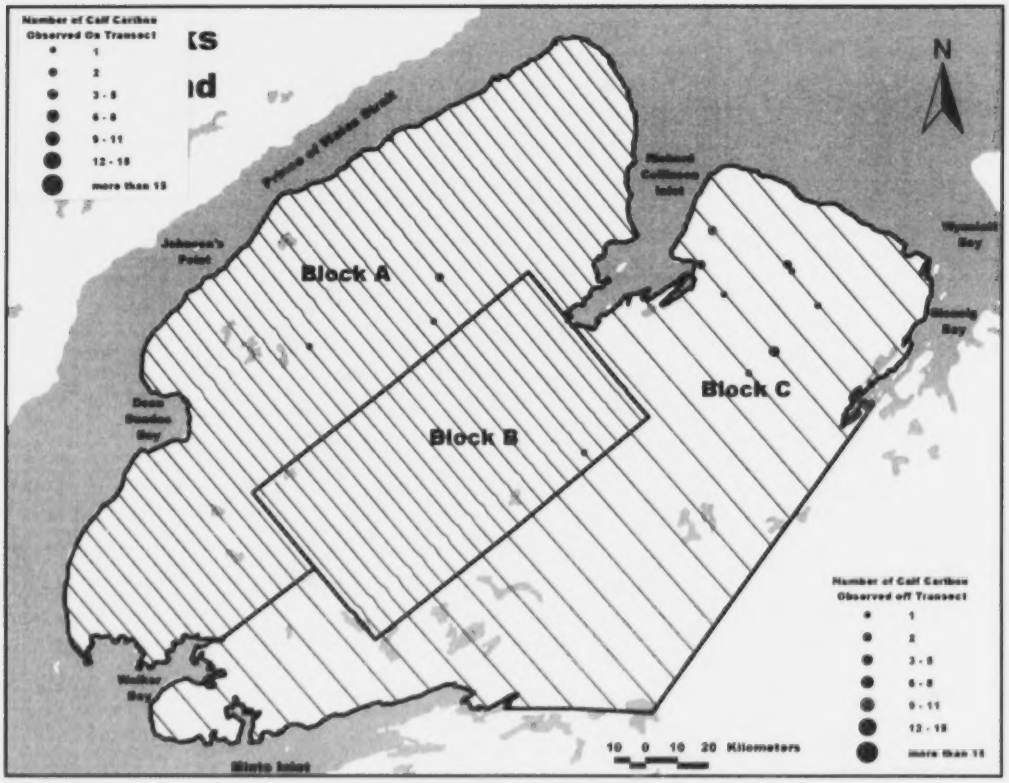

Figure 5. Distribution of calf caribou on northwest Victoria Island during July 2005.

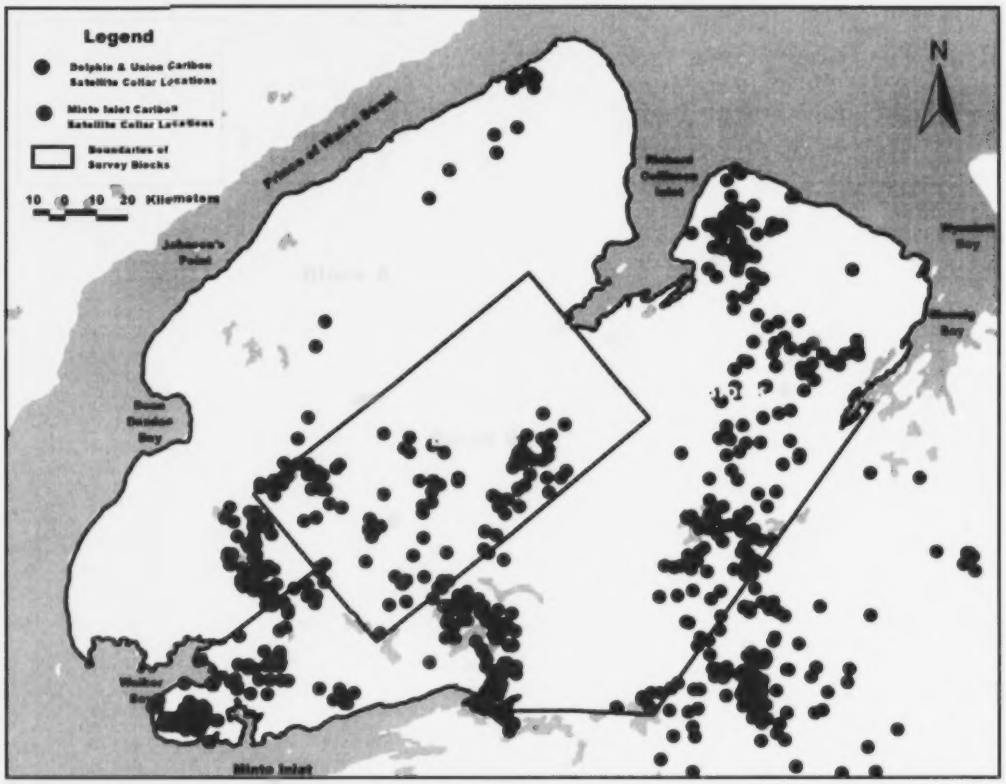

Figure 6. Distribution of satellite collared cow Minto Inlet Peary caribou and Dolphin & Union caribou in relation to the boundaries of the survey blocks on northwest Victoria Island.[A]

[A] Satellite location data are from the followings sources:
- Minto Inlet Peary caribou: 1987 to 1989 (Gunn and Fournier, 2000)
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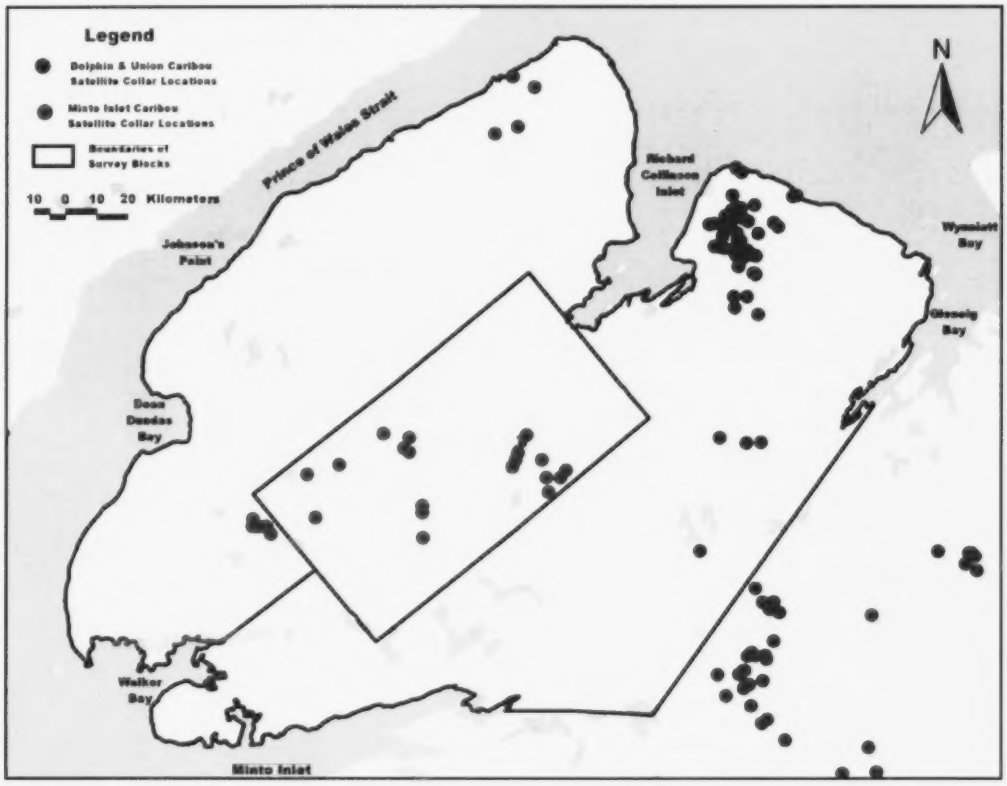

Figure 7. Distribution of satellite collared cow Minto Inlet Peary caribou and Dolphin & Union caribou during 15 July to 15 August in relation to the boundaries of the survey blocks on northwest Victoria Island.[A]

[A] Satellite location data are from the followings sources:
- Minto Inlet Peary caribou: 1987 to 1989 (Gunn and Fournier, 2000)
- Dolphin & Union caribou: 1996 to 1998 J. Nishi (unpublished data) and 2003 to 2005 (J. Nagy, unpublished data)

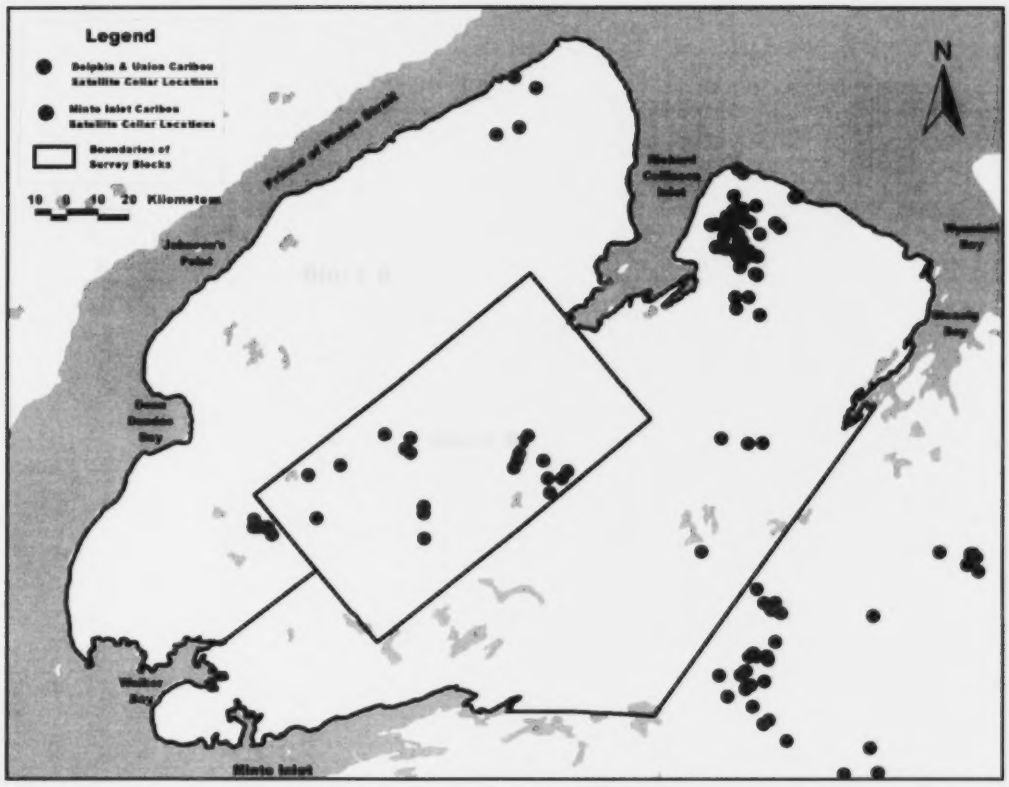

Figure 7. Distribution of satellite collared cow Minto Inlet Peary caribou and Dolphin & Union caribou during 15 July to 15 August in relation to the boundaries of the survey blocks on northwest Victoria Island.[A]

[A] Satellite location data are from the followings sources:
- Minto Inlet Peary caribou: 1987 to 1989 (Gunn and Fournier, 2000)
- Dolphin & Union caribou: 1996 to 1998 J. Nishi (unpublished data) and 2003 to 2005 (J. Nagy, unpublished data)

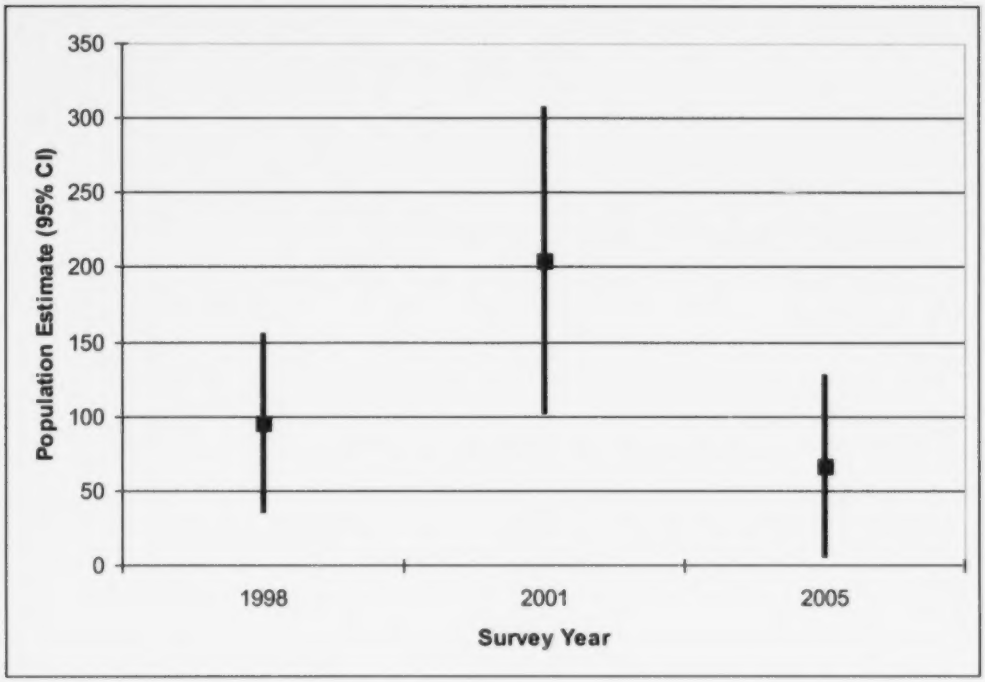

Figure 8. Population estimates with 95% CI for non-calf Minto Inlet Peary caribou on northwest Victoria Island, NT, 1998 to 2005[A].

[A] Population estimates obtained from:
- 1998 (Nagy *et al.*, 2007g)
- 2001 (Nagy *et al.*, 2007h)
- 2005 (this study)

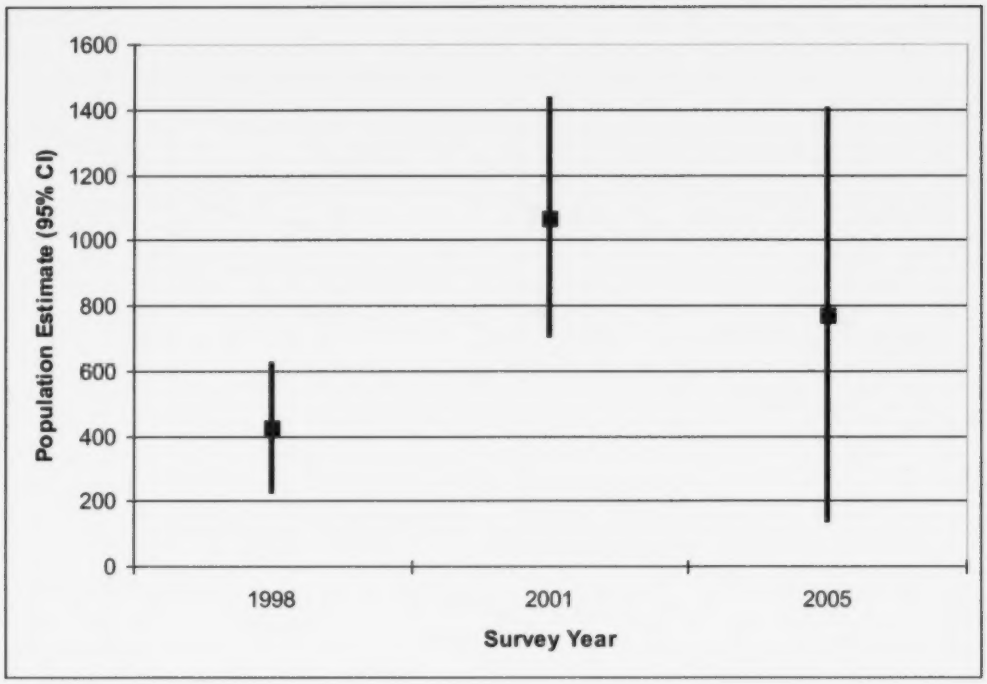

Figure 9. Population estimates with 95% CI for non-calf Dolphin & Union caribou on northwest Victoria Island, NT, 1998 to 2005[A].

[A] Population estimates obtained from:
- 1998 (Nagy *et al.*, 2007g)
- 2001 (Nagy *et al.*, 2007h)
- 2005 (this study)

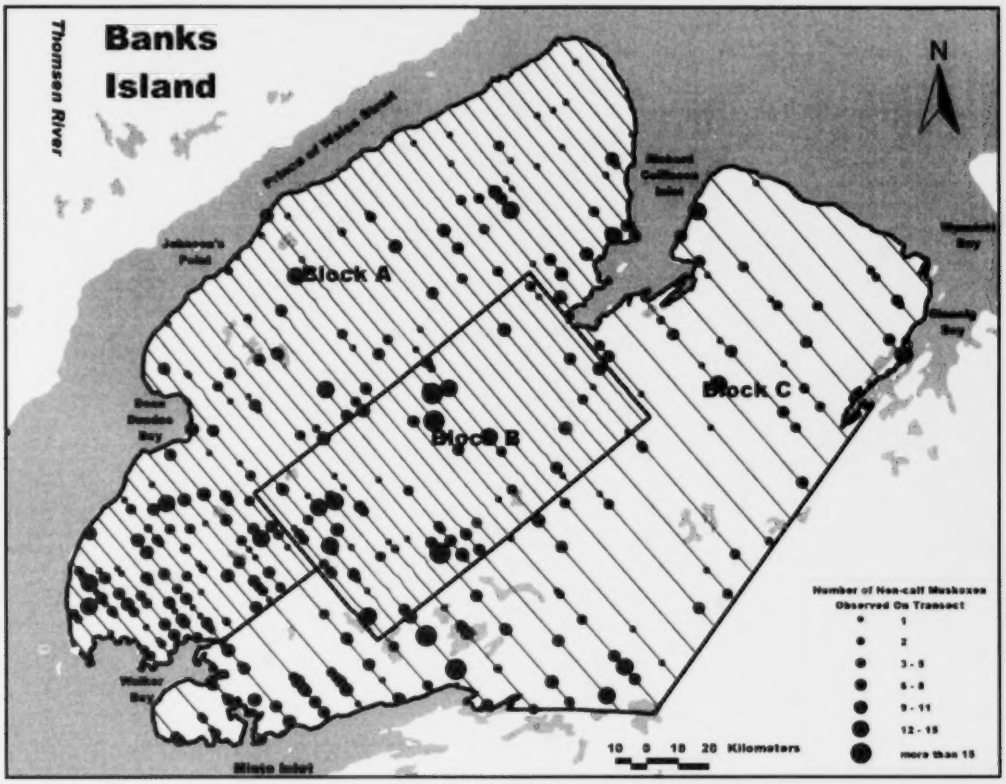

Figure 10. Distribution of non-calf muskoxen on northwest Victoria Island during July 2005.

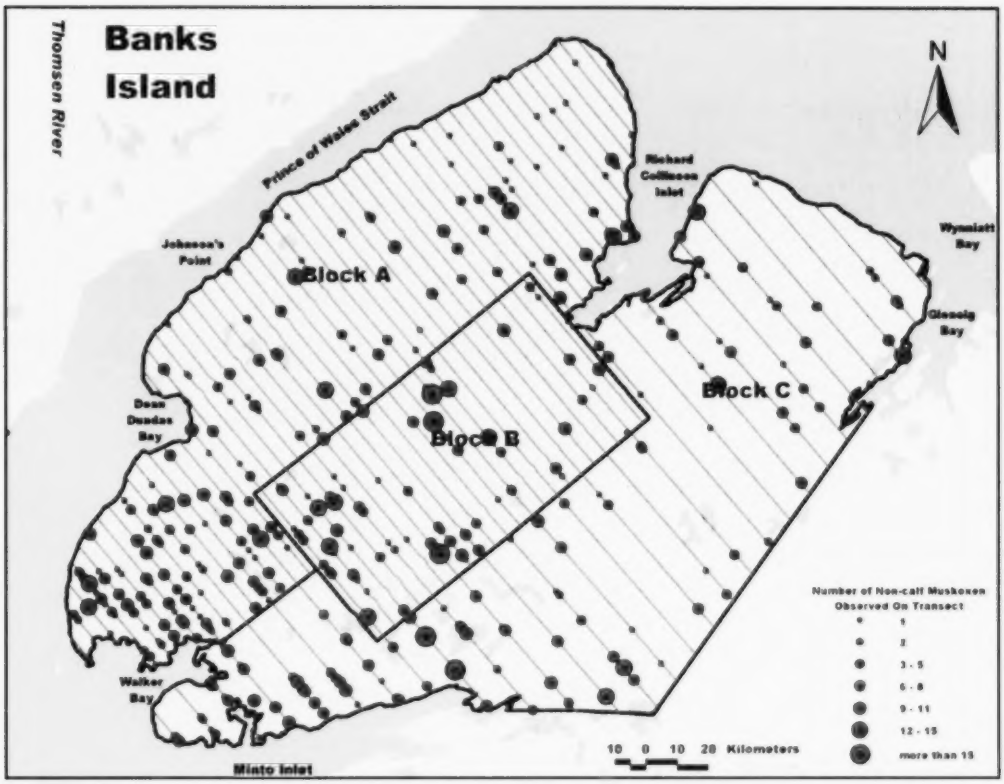

Figure 10. Distribution of non-calf muskoxen on northwest Victoria Island during July 2005.

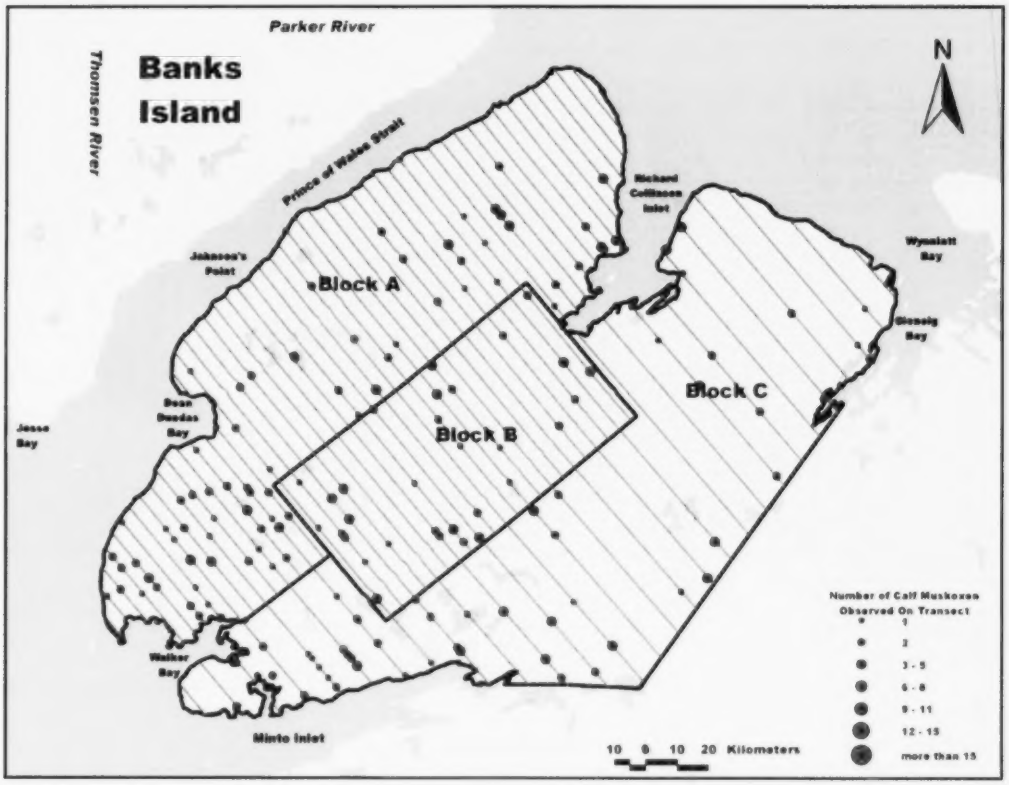

Figure 11. Distribution of calf muskoxen on northwest Victoria Island during July 2005.

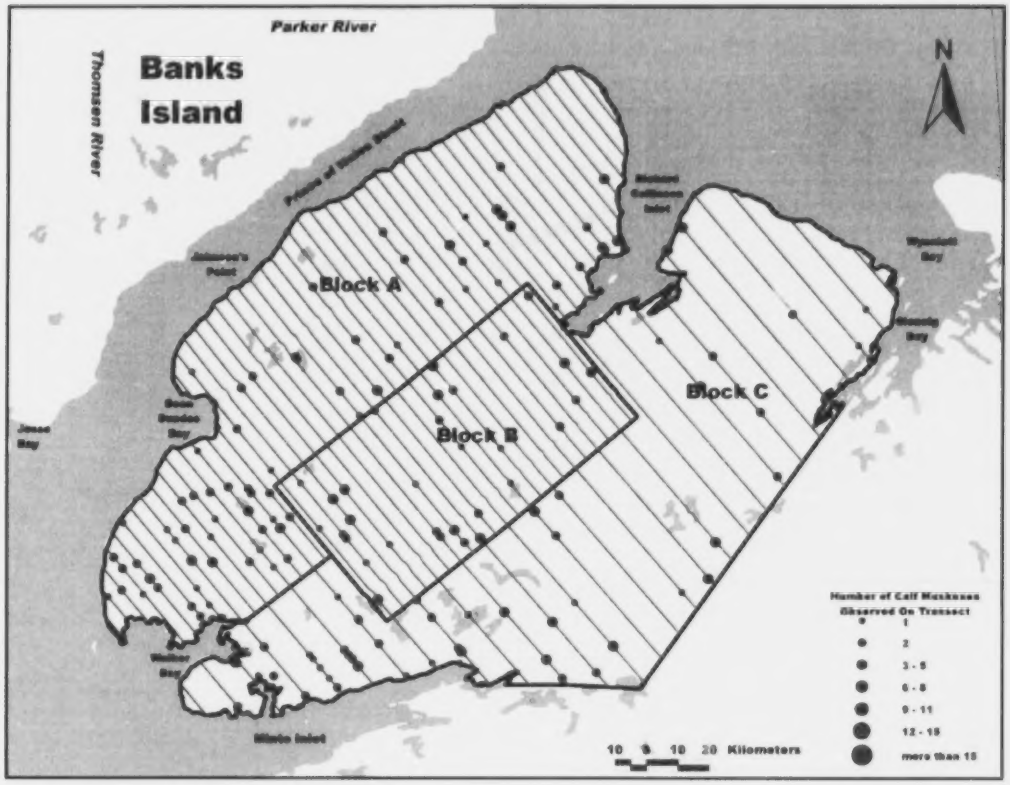

Figure 11. Distribution of calf muskoxen on northwest Victoria Island during July 2005.

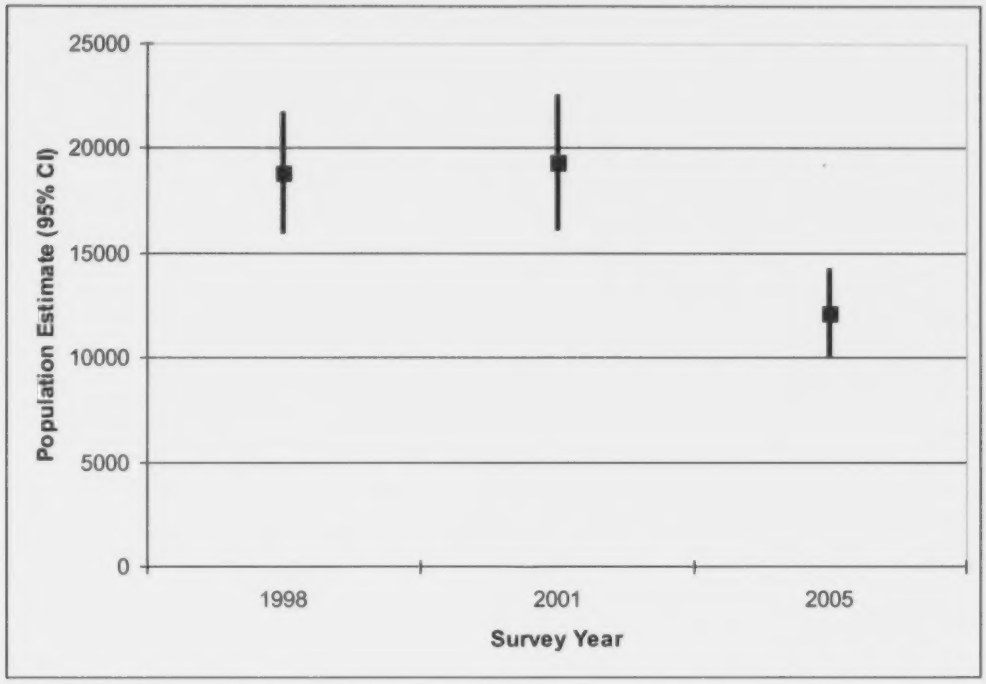

Figure 12. Population estimates with 95% CI for non-calf muskoxen on northwest Victoria Island, NT, 1998 to 2005[A].

[A] Population estimates obtained from:
- 1998 (Nagy *et al.*, 2007g)
- 2001 (Nagy *et al.*, 2007h)
- 2005 (this study)

Figure 13. Distribution of wolves observed during the 2005 northwest Victoria Island caribou and muskoxen survey.

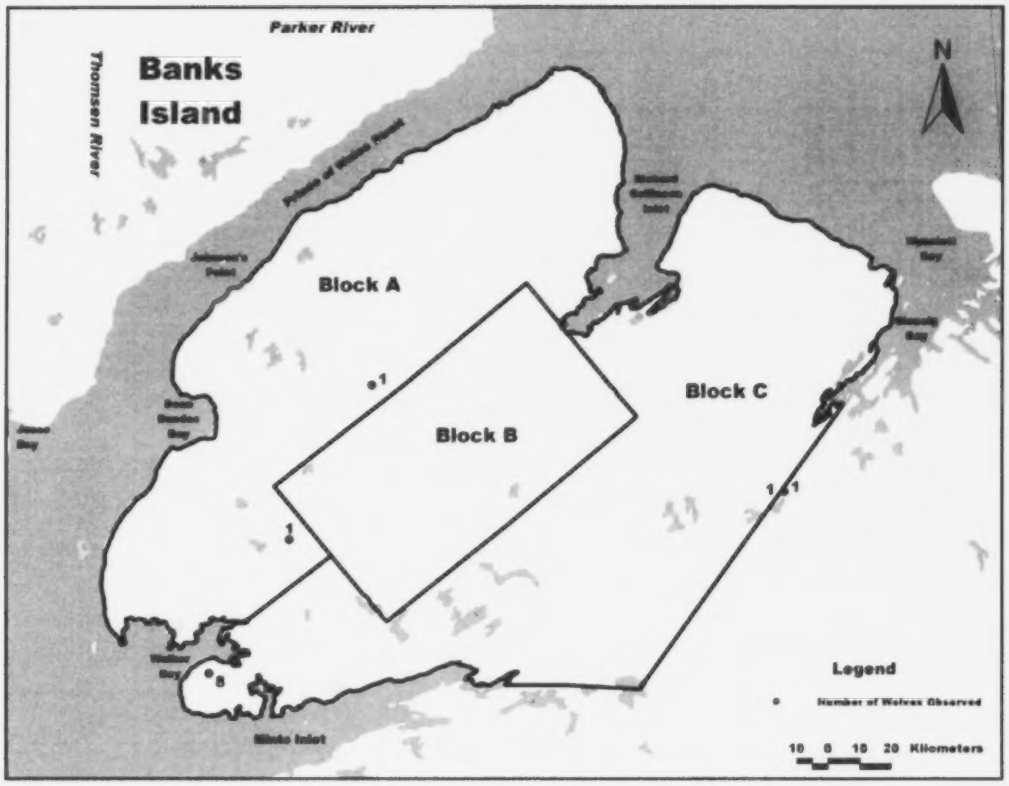

Figure 13. Distribution of wolves observed during the 2005 northwest Victoria Island caribou and muskoxen survey.

Table 1. Population estimates for caribou on northwest Victoria Island, July 2005.

Survey Block	Census Area (km^2)	Number of Transects Flown	Number of Possible Transects	Density (per km^2)	Population Total	Variance of Totals	S.E. of Y	95% Confidence Interval (±)	% of Total Area Sampled	Number On Transect	Number Off Transect	Coefficient Of Variation	df
Caribou: Non-calf													
A	13799	49	245.7	0.004	51	731.5	27.0	54	19.7	10	0	0.534	
B	6565	22	109.9	0.002	15	179.8	13.4	28	20.1	3	0	0.897	
C	15657	28	279.2	0.049	769	96315.3	310.3	637	10.0	77	23	0.403	
sum of blocks	36021	99	634.8	0.023	835	97226.6	311.8	640	15.6	90	23	0.373	27
Caribou: Calf													
A	13799	49	245.7	0.002	20	115.4	10.7	22	19.7	4	0	0.530	
B	6565	22	109.9	0.001	5	20.0	4.5	9	20.1	1	0	0.897	
C	15657	28	279.2	0.008	120	3809.2	61.7	127	10.0	12	1	0.515	
sum of blocks	36021	99	634.8	0.004	145	3944.6	62.8	129	15.6	17	1	0.433	27
Caribou: Total													
A	13799	49	245.7	0.005	71	1300.8	36.1	73	19.7	14	0	0.508	
B	6565	22	109.9	0.003	20	319.6	17.9	37	20.1	4	0	0.897	
C	15657	28	279.2	0.057	889	131032.2	362.0	743	10.0	89	24	0.407	
sum of blocks	36021	99	634.8	0.027	980	132652.5	364.2	747	15.6	107	24	0.372	27

Table 2. Population estimates for Peary caribou (Minto Inlet herd) and Dolphin & Union caribou on northwest Victoria Island, July 1998.

Survey Block	Census Area (km^2)	Number of Transects Flown	Number of Possible Transects	Density (per km^2)	Population Total	Variance of Totals	S.E. of Y	95% Confidence Interval (±)	% of Total Area Sampled	Number On Transect	Number Off Transect	Coefficient Of Variation	df
Minto Inlet Peary Caribou													
Caribou: Non-calf													
A	13799	49	245.7	0.004	51	731.5	27.0	54	19.7	10	0	0.534	
B	6565	22	109.9	0.002	15	179.8	13.4	28	20.1	3	0	0.897	
sum of blocks	20364	71	355.6	0.003	66	911.3	30.2	61	27.5	13	0	0.460	47
Caribou: Calf													
A	13799	49	245.7	0.002	20	115.4	10.7	22	19.7	4	0	0.530	
B	6565	22	109.9	0.001	5	20.0	4.5	9	20.1	1	0	0.897	
sum of blocks	20364	71	355.6	0.001	25	135.4	11.6	23	27.5	5	0	0.461	48
Caribou: Total													
A	13799	49	245.7	0.005	71	1300.8	36.1	73	19.7	14	0	0.508	
B	6565	22	109.9	0.003	20	319.6	17.9	37	20.1	4	0	0.897	
sum of blocks	20364	71	355.6	0.004	91	1620.3	40.3	81	27.5	18	0	0.443	47
Dolphin & Union Caribou													
Caribou: Non-calf													
C	15,657	28	279.2	0.049	769	96315.3	310.3	637	10.01	77	23	0.403	27
Caribou: Calf													
C	15,657	28	279.2	0.008	120	3809.2	61.7	127	10.01	12	1	0.515	27
Caribou: Total													
C	15,657	28	279.2	0.057	889	131032.2	362.0	743	10.01	89	24	0.407	27

Table 3. Population estimates for muskox on northwest Victoria Island, July 2005.

Survey Block	Census Area (km^2)	Number of Transects Flown	Number of Possible Transects	Density (per km^2)	Population Total	Variance of Totals	S.E. of Y	95% Confidence Interval (±)	% of Total Area Sampled	Number On Transect	Number Off Transect	Coefficient Of Variation	df
Muskox: Non-calf													
A	13799	49	245.7	0.310	4284	222113.1	471.3	948	19.7	845	not recorded	0.110	
B	6565	22	109.9	0.300	1972	84704.5	291.0	605	20.1	396	not recorded	0.148	
C	15657	28	279.2	0.371	5806	796974.9	892.7	1832	10.0	581	not recorded	0.154	
sum of blocks	36021	99	634.8	0.335	12062	1103792.4	1050.6	2156	15.6	1822		0.087	27
Muskox: Calf													
A	13799	49	245.7	0.056	765	8802.1	93.8	189	19.7	151	not recorded	0.123	
B	6565	22	109.9	0.054	354	2961.1	54.4	113	20.1	71	not recorded	0.154	
C	15657	28	279.2	0.063	989	22625.7	150.4	309	10.0	99	not recorded	0.152	
sum of blocks	36021	99	634.8	0.059	2108	34388.9	185.4	380	15.6	321		0.088	27
Muskox: Total													
A	13799	49	245.7	0.366	5049	302913.6	550.4	1107	19.7	996	not recorded	0.109	
B	6565	22	109.9	0.354	2326	113155.3	336.4	700	20.1	467	not recorded	0.145	
C	15657	28	279.2	0.434	6795	1033921.7	1016.8	2087	10.0	680	not recorded	0.150	
sum of blocks	36021	99	634.8	0.393	14170	1449990.6	1204.2	2471	15.6	2143		0.085	27

APPENDIX 1.

Transect data for the 2005 northwest Victoria Island caribou and muskoxen survey.

Survey Block	Transect Number	Transect Area (km^2)	Caribou: Non-calf	Caribou: Calf	Caribou: Total	Muskox: Non-calf	Muskox: Calf	Muskox: Total
A	A01	9.674	0	0	0	9	2	11
	A02	12.728	0	0	0	7	1	8
	A03	25.221	0	0	0	19	2	21
	A05	41.746	0	0	0	47	5	52
	A06	44.408	0	0	0	36	9	45
	A07	46.309	0	0	0	43	5	48
	A08	49.310	0	0	0	40	4	44
	A09	55.087	0	0	0	50	5	55
	A10	56.313	0	0	0	27	6	33
	A11	59.476	0	0	0	18	3	21
	A12	61.646	0	0	0	39	6	45
	A13	61.395	0	0	0	35	4	39
	A14	59.764	0	0	0	40	10	50
	A15	57.949	0	0	0	33	8	41
	A16	68.868	0	0	0	29	5	34
	A18	56.774	0	0	0	22	4	26
	A19	58.851	0	0	0	2	0	2
	A20	59.452	0	0	0	7	2	9
	A21	59.878	0	0	0	16	2	18
	A22	61.420	0	0	0	3	0	3
	A23	61.090	0	0	0	17	0	17
	A24	60.814	0	0	0	14	4	18
	A25	60.531	0	0	0	21	3	24
	A26	61.672	3	1	4	13	0	13
	A27	61.716	0	0	0	6	3	9
	A28	63.312	0	0	0	21	6	27
	A29	35.067	0	0	0	18	3	21
	A30	66.697	0	0	0	4	1	5
	A31	66.366	0	0	0	1	0	1
	A32	64.322	0	0	0	3	0	3
	A33	62.668	5	1	6	0	0	0
	A34	61.528	0	0	0	23	6	29
	A35	61.779	2	2	4	0	0	0
	A36	61.930	0	0	0	6	1	7
	A37	59.821	0	0	0	17	5	22
	A38	59.047	0	0	0	5	1	6
	A39	59.688	0	0	0	11	2	13
	A40	74.421	0	0	0	18	1	19
	A41	74.507	0	0	0	48	13	61
	A42	72.488	0	0	0	2	0	2
	A43	66.301	0	0	0	11	2	13
	A45	62.741	0	0	0	6	2	8

Survey Block	Transect Number	Transect Area (km^2)	Caribou: Non-calf	Caribou: Calf	Caribou: Total	Muskox: Non-calf	Muskox: Calf	Muskox: Total
	A46	63.736	0	0	0	24	7	31
	A47	64.295	0	0	0	16	5	21
	A48	54.146	0	0	0	13	3	16
	A49	46.271	0	0	0	0	0	0
	A50	43.593	0	0	0	0	0	0
	A51	38.643	0	0	0	5	0	5
	A52	26.543	0	0	0	0	0	0
	Total	2655.701	10	4	14	845	151	996
B	B01	60.134	0	0	0	34	5	39
	B02	60.151	0	0	0	48	6	54
	B03	60.169	0	0	0	32	7	39
	B04	60.187	0	0	0	24	5	29
	B05	60.204	0	0	0	14	0	14
	B06	60.222	0	0	0	1	0	1
	B07	60.239	0	0	0	35	4	39
	B08	60.256	0	0	0	27	6	33
	B09	60.273	0	0	0	23	5	28
	B10	60.290	0	0	0	5	2	7
	B11	60.308	0	0	0	7	0	7
	B12	60.235	0	0	0	30	3	33
	B13	60.113	0	0	0	22	5	27
	B14	59.991	0	0	0	38	8	46
	B15	59.869	0	0	0	0	0	0
	B16	59.747	0	0	0	9	0	9
	B17	59.624	0	0	0	0	0	0
	B18	59.502	3	1	4	11	2	13
	B19	59.380	0	0	0	9	2	11
	B20	59.258	0	0	0	5	2	7
	B21	59.136	0	0	0	8	3	11
	B22	58.956	0	0	0	14	6	20
	Total	1318.244	3	1	4	396	71	467
C	C01	13.579	0	0	0	12	0	12
	C03	23.385	0	0	0	10	2	12
	C05	15.894	0	0	0	12	0	12
	C07	34.501	0	0	0	36	4	40
	C09	39.938	0	0	0	42	6	48
	C11	43.780	0	0	0	27	9	36
	C13	49.378	0	0	0	33	7	40
	C15	23.315	0	0	0	9	1	10
	C17	39.347	0	0	0	71	9	80
	C19	47.611	0	0	0	26	1	27
	C21	55.914	0	0	0	34	8	42
	C23	65.165	0	0	0	20	5	25
	C25	69.934	11	0	11	36	5	41
	C27	68.846	0	0	0	20	7	27
	C29	66.257	0	0	0	3	2	5

Survey Block	Transect Number	Transect Area (km^2)	Caribou: Non-calf	Caribou: Calf	Caribou: Total	Muskox: Non-calf	Muskox: Calf	Muskox: Total
	C31	63.669	0	0	0	14	1	15
	C33	61.078	0	0	0	6	3	9
	C35	58.488	0	0	0	14	3	17
	C37	90.759	9	0	9	12	0	12
	C39	86.221	5	0	5	1	0	1
	C41	82.440	0	0	0	32	6	38
	C43	73.089	1	1	2	17	4	21
	C45	82.292	32	6	38	26	4	30
	C47	82.071	11	2	13	30	4	34
	C49	80.800	3	3	6	3	2	5
	C51	76.848	5	0	5	22	5	27
	C53	49.068	0	0	0	13	1	14
	C55	23.156	0	0	0	0	0	0
	Total	1566.823	77	12	89	581	99	680